Feb. 23, 1971 A. F. LOEBLE 3,566,349

VEHICLE ANTI-THEFT SYSTEM

Filed Oct. 25, 1967

FIG. 1

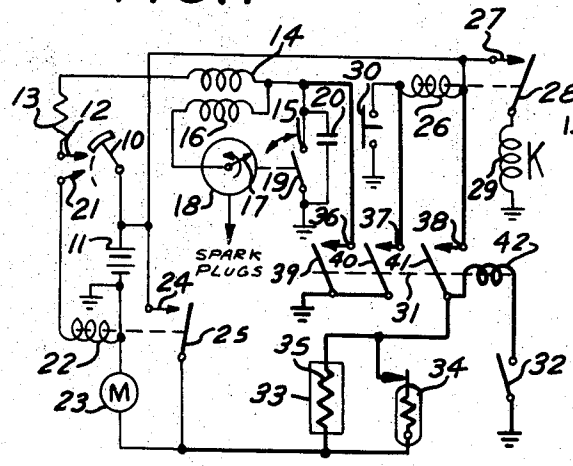


FIG. 2

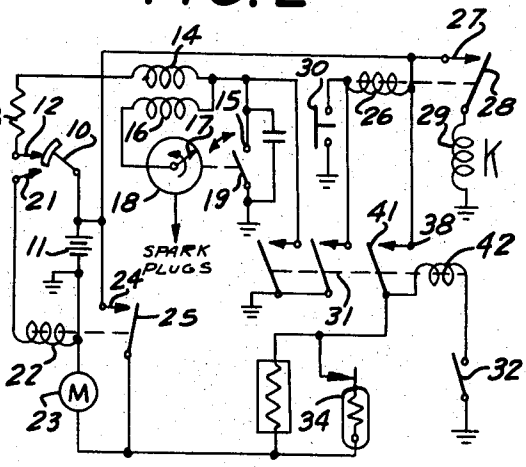


FIG. 3

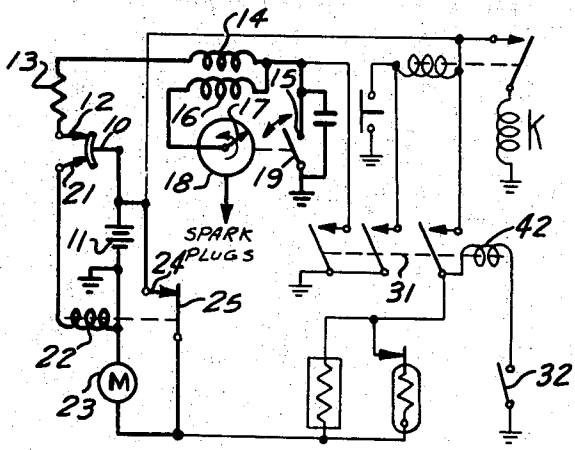


FIG. 4

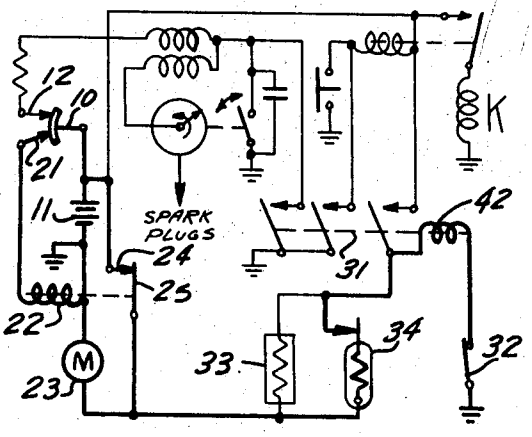


FIG. 5

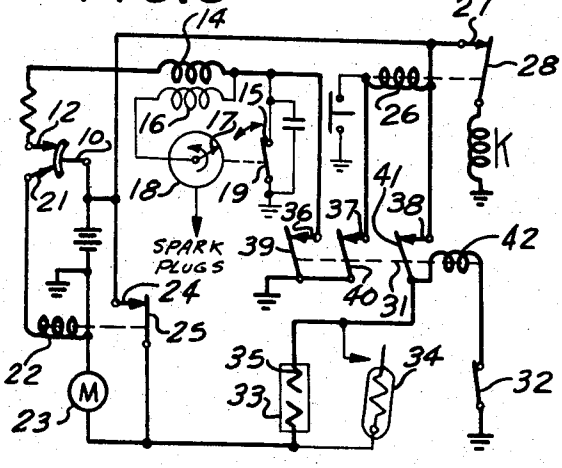
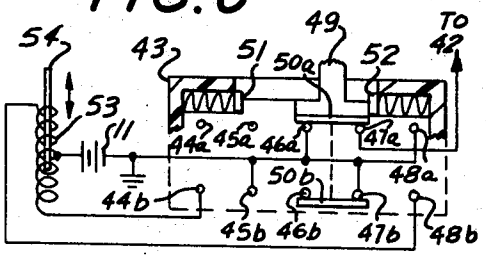


FIG. 6



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VEHICLE ANTI-THEFT SYSTEM

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ABSTRACT OF THE DISCLOSURE

An auxiliary circuit package addable to the existing electrical circuitry of an internal combustion engine automotive vehicle including a multi-pole relay and arming switch, and optionally including a tear gas bomb and/or engine compartment latch lock, the bomb when used being dischargeable at a selected time into the vehicle driver occupant compartment. When the auxiliary is armed the engine compartment is locked and any attempt to then start the engine without first disarming the auxiliary circuit actuates the relay, thereby grounding the ignition coil primary winding to prevent ignition spark generation, continuously sounding the vehicle horn, and firing the tear gas bomb with or without a time delay. When disarmed the auxiliary circuitry has no effect whatever on the normal vehicle operation.

This invention relates to a physically small, simple and inexpensive device for preventing theft of an automotive vehicle by disabling the the motive system of the vehicle. Additionally, an audible alarm is sounded utilizing the warning horn which is a normal part of such vehicles. Optionally provided is a tear gas bomb which may be set to discharge into the vehicle driver location to disable a would-be thief so that he may be readily apprehended. The tear gas bomb may be provided with a time delay mechanism so that it will not immediately discharge when the anti-theft system is triggered inadvertently by the owner of the vehicle by virtue of an oversight in failing to disarm the system. The owner may then quickly disarm the circuit and prevent actuation of the bomb. This does not defeat the system since the vehicle owner will normally be the only person knowing the location of the arming/disarming actuating device.

The auxiliary circuit package for the anti-theft system is installed in the engine compartment and may be made tamperproof by the utilization of a hood latch locking device actuatable by the arming switch to lock the hood and thereby prevent disconnection of the anti-theft system prior to an attempted theft.

Accordingly, it is the object of this invention to provide a vehicle anti-theft system as hereinbefore described, and other objects will become apparent from a reading of the following specification in conjunction with an examination of the appended drawings, wherein:

FIG. 1 is a schematic diagram of a portion of the electrical system of an automotive vehicle shown together with the auxiliary electrical circuitry of the vehicle anti-theft system, the auxiliary circuitry being shown in heavier line;

FIGS. 2 and 3 are schematic diagrams as in FIG. 1 illustrating the current flow conditions with the anti-theft system disabled and with the ignition switch successively advanced into an ignition-on condition and motor starting condition.

FIG. 4 is a schematic diagram similar to that shown in FIG. 3 excepting that the anti-theft system is in an armed condition;

FIG. 5 is similar to FIG. 4 but shows conditions at a time subsequent to that shown in FIG. 4; and

FIG. 6 is a representational showing of a modified form of circuit arming switch which provides automatic operation of a hood locking circuit.

In the several figures, like elements are denoted by like reference characters.

Turning now to the drawings, examine first FIG. 1 which shows in lighter weight line the ignition system and horn portions of the electrical circuitry of an automotive vehicle, and in heavier weight line the additional circuitry which is added to provide the vehicle anti-theft system. In the normal manner, the pole **10** of the ignition switch is connected to the positive terminal of the battery **11** which latter has its negative terminal grounded to the chassis of the vehicle; one contact **12** of the ignition switch is connected through current limiting resistor **13** and ignition coil primary winding **14** to one contact **15** of the distributor breaker points, and through ignition coil secondary winding **16** to the rotor **17** of the distributor **18**, the movable breaker point contact **19** being grounded and having the usual capacitor **20** connected across the points; and the ignition switch starting contact **21** is connected to one end of starting motor solenoid **22** with the other end of the coil as well as one side of starting motor **23** being grounded.

Contact **24** of the starter solenoid switch is connected to the positive terminal of battery **11** while the movable contact **25** is connected to the ungrounded end of the starting motor **23** windings. One end of horn solenoid winding **26** connects to the positive terminal of battery **11** and contact **27** of the horn solenoid switch, which latter has its movable contact **28** connected to one end of the horn armature winding **29**, the opposite end of the winding being grounded. The end of the horn solenoid winding **26** which is not connected to the battery **11** is returned to ground in the usual manner through the horn ring switch **30**.

The anti-theft auxiliary system includes the three pole relay **31**, the arming switch **32**, tear gas bomb **33** and thermal cut-out switch **34**. The tear gas bomb **33** and thermal cut-out switch **34** are alternative optional features and one or the other may be dispensed with if desired as will be subsequently explained. Additionally, the engine compartment hood latch lock circuit is shown in FIG. 6 in conjunction with a modified form of arming switch and will be subsequently described.

Relay **31** is provided with three contacts **36**, **37** and **38**, contact **36** being connected to ignition breaker points contact **15**, contact **37** being connected to the horn ring switch end of horn solenoid winding **26**, while contact **38** connects to the positive terminal of battery **11**. Associated respectively with relay contacts **36**, **37** and **38** are normally open relay poles **39**, **40** and **41**, poles **39** and **40** being connected together and grounded while pole **41** connects to one end of the winding **42** of relay **31** and also to one end of thermal cut-out switch **34** and one end of igniter element **35** of tear gas bomb **33**. The opposite end of thermal cut-out switch **34** and igniter element **35** are connected together and commonly to starter solenoid switch contact **25**. The opposite end of relay winding **42** is connected to the open contact of arming switch **32**.

Tear gas bomb **33** is of the electrically actuated type having an igniter element **35** which when subjected to a suitable current flow therethrough becomes very hot and ignites the chemical composition which generates the tear gas. The igniter is characterized by an irreversible action in that once the ignition cycle has been started it cannot thereafter be terminated and the igniter element is self-destructive by thermal burn-out. Typically, this tear gas bomb device could be a model EACS–1 made by Pyrodynamics, Inc. of Atglen, Pa. The thermal cut-out switch **34** can be the grasshopper type resettable fuse switch in-

cluding a bi-metal as the movable contact which when subjected to a predetermined current flow heats up to a point sufficient to open the circuit, the spring action built into the movable contact carrying the latter away from the fixed contact so that termination of the heating current flow therethrough does not re-establish the switch in a closed state. The thermal cut-out switch can be made to operate substantially instantaneously or after a delay time as desired. For the instant application, a delay time of up to approximately ten seconds may be desirable.

FIG. 1 illustrates the circuit with the ignition switch in its completely open condition as when the ignition is turned off, and with the arming switch **32** in its open state. FIGS. 2 and 3 illustrate the normal functioning of the automobile ignition system when the arming circuit remains in its open state, in the following way.

As shown in FIG. 2, the ignition switch pole **10** has been moved from the off position into contact with ignition switch fixed contact **12** so that the battery **11** is connected through resistor **13** and ignition coil primary winding **14** to the breaker point contact **15**. No current will flow through the ignition coil primary **14** if the breaker points are not closed, and this will be the usual case, so that no high voltage will be developed across the ignition coil secondary winding **16** for transmission to the rotor **17** of the distributor **18**. Even if the breaker points had been closed, only a single high voltage pulse could be transmitted through the distributor to one spark plug, and ignition will not occur because the fuel conditions in the cylinder are not proper due to lack of compression. Since the circuit from the battery **11** to the starting solenoid **22** is open, the starting motor **23** is not energized nor is it possible for current to flow from the battery over toward the auxiliary electrical circuit. The horn could of course be operated if desired by merely closing the horn ring switch **30** to pull current through horn solenoid winding **26** to close switch contacts **27** and **28** and permit current flow through horn armature winding **29** and thereby sound the horn.

FIG. 3 shows the condition where the ignition switch pole **10** has been further advanced into the starting position so that it now contacts both of the fixed contacts **12** and **21** of the ignition switch to not only permit current flow through the ignition coil primary winding **14** and the breaker points **15** and **19** when the latter are in contact, but also to permit current flow from the battery **11** through the starter solenoid coil **22** to thereby pull into engagement the fixed and movable starter solenoid switch contacts **24** and **25** so that the starting motor **23** is energized from the battery and turns the crank shaft to drive the engine pistons and open and close the ignition breaker points **15** and **19**. Ignition of course then occurs in the normal fashion, but it will be observed that the auxiliary circuit remains completely de-energized because arming switch **32** is open, thereby preventing current flow through the winding **42** of relay **31**.

FIG. 4 illustrates the same circuit conditions as shown in FIG. 3 with one exception, the exception being that prior to operation of the ignition switch, the arming switch **32** has been closed as shown. With the arming switch **32** closed and the ignition off as shown in FIG. 1, it will be apparent that nothing would occur since the coil **42** of relay **31** cannot be energized from the battery **11** since all possible current conduction paths therefrom are in an open-circuit state. Similarly, an examination of FIG. 2 in which the pole **10** of the ignition switch has been engaged with the fixed contact **12** shows identically the same electrical conditions insofar as the winding **42** of relay **31** is concerned. When however, as shown in FIG. 4, the ignition switch pole **10** is moved into the engine starting position by bringing it into engagement with fixed contact **21**, the circuit conditions are altered drastically.

FIG. 4 shows the circuit conditions immediately after

battery current has been applied to starter solenoid **22** to close the starter solenoid switch contacts **24** and **25** to apply battery voltage to the starting motor **23**. At this same instant current is also provided from the battery **11** through starter solenoid contacts **24** and **25** to winding **42** of relay **31** through the closed arming switch **32** and thermal cut-out switch **34**. The energization of relay winding **42** within a matter of milliseconds, and before the starting motor **23** can drive the crank shaft to cause ignition, pulls the relay poles **39**, **40** and **41** into engagement with their respective contacts **36**, **37** and **38**, as shown in FIG. 5.

The closure of pole **39** to contact **36** short-circuits the ignition breaker point **15** to ground to thereby draw a fixed current through the ignition coil primary winding **14** regardless of the opening and closing of the breaker points **19** and **15**. Consequently, although the starting motor **23** may be energized and turning the crank shaft, nevertheless, no high voltage pulses are developed by the ignition coil secondary winding **16** and the spark plugs of the engine are therefore prevented from firing, thereby completely disabling the engine.

A holding current circuit is established for winding **42** of relay **31** through the now closed pole **41** and contact **38** of the relay so that even if the ignition were turned off completely to thereby open the starter solenoid contacts **24** and **25**, nevertheless, relay winding **42** would remain energized and the relay poles would remain in engagement with their associated contacts. Similarly, current flow would be maintained from the battery through the relay pole **41** and contact **38** through the thermal cut-out switch **34** and the starting motor **23** back to the battery ground. The current flow through the thermal cut-out switch **34** is of course completely ineffective to turn over the starting motor **23** but is all that is required to cause the thermal cut-out switch **34** to open up after the preset time delay and thereby apply the battery voltage to the igniter element **35** of the tear gas bomb **33**.

The igniter element will of course, as previously described, ignite the tear gas charge and then burn itself open to thereby remove the drain on the battery **11** which would otherwise be imposed by the substantial short-circuit of the starting motor winding. Should no time delay be desired for discharge of the tear gas bomb **33**, the thermal cut-out switch **34** may be eliminated from the circuit so that battery voltage will be immediately applied to the tear gas bomb and cause substantially no delay in discharge. Alternatively, if it is not desired to use a tear gas bomb **33** then the thermal cut-out switch or an equivalent fuse element is required so that the relay winding **42** may be energized upon closure of the starter solenoid switch, and so that the substantial load imposed by the starting motor **23** may be removed from the battery **11** after the relay holding circuit is established through pole **41** and contact **38**.

The closure of pole **40** and contact **37** of relay **31** also established current flow from the battery **11** through horn solenoid winding **26** to ground to thereby close the pole **28** and contact **27** of the horn solenoid switch to thereby energize the horn armature winding **29** and sound the horn continuously. It will be observed from the circuit conditions of FIG. 5 that once relay **31** has pulled in the vehicle power plant is disabled, an audible alarm is sounded, and optionally the driver compartment of the vehicle is flooded with tear gas. This same result will occur even if an ignition key is not used, but if the ignition system is jumpered from the driver compartment. When this anti-theft system is used in conjunction with a latch lock device, it is apparent that a potential thief cannot gain access to the engine compartment for purposes of disabling the system. A latch lock system actuated by a modified form of arming switch is illustrated in the showing of FIG. 6 to which attention should now be directed.

A modified form of arming switch is shown in FIG. 6 and designated generally as **43**, this switch being of the well-known two-circuit four-position slide switch type in which a pair of adjacent contacts are connected together for each of the four positions of the slider. In the showing of FIG. 6, the contacts are designated for the upper circuit as **44***a* through **48***a* and for the lower circuit as **44***b* through **48***b*. The contact shorting bars which are shiftable together by the operating button **49** are designated for the upper and lower circuits respectively as **50***a* and **50***b*.

Additionally incorporated into the switch **43** are a pair of spring elements **51** and **52** disposed at opposite ends of the switch for engagement by the operating button **49** when the latter is pushed to the extreme end positions to connect together either the contact sets **44** and **45** or the contact sets **47** and **48**. At such time, the respective spring **51** or **52** is compressed so that when holding pressure on the operating button **49** is released, the spring engaged therewith shifts the operating button backward to the next circuit position. That is, into a position where the shorting bars **50***a* and **50***b* are connecting together either their respectively associated contacts **45** and **46** or contacts **46** and **47**, depending upon which of the springs **51** and **52** is effecting the restoring movement.

As shown, switch contacts **45***b*, **46***a*, **47***b* and **48***a* are connected together and grounded, contact **47***a* is connected to the end of relay winding **42** as illustrated in FIGS. 1 through 5, and contacts **44***b* and **48***b* are respectively connected to opposite ends of a center-tapped solenoid winding **53**, the center-tap of which is connected to the positive terminal of the automotive vehicle battery **11**. The solenoid plunger **54** is shiftable in opposite directions within the solenoid winding **53** by energization of different ones of the half-winding sections. The plunger **54** is used in a deadman arrangement to lock or unlock the already existing hood latch of the automotive vehicle by shifting of the plunger in one direction to effect locking and in the opposite direction to effect unlocking.

As shown in FIG. 6, the solenoid plunger **54** has been shifted to a hood locking position and the relay winding **42** is in an armed condition by establishment of the circuit to ground through the switch contacts **46***a* and **47***a* and shorting bar **50***a* connecting the latter together. When the arming button **49** was moved into the circuit arming position, it was first pushed to its limit of travel in the right hand direction so that shorting bar **50***b* closed the circuit between switch contacts **47***b* and **48***b* to thereby apply battery current to the upper half of the solenoid winding **53** to shift the plunger **54** in that direction and lock the hood mechanism.

When it is desired to disarm the circuit, the operating button **49** is shifted to the extreme left against the return biasing action of spring **51** so that shorting bar **50***b* then connects together switch contacts **44***b* and **45***b* to thereby energize the lower half of solenoid winding **53** from the battery **11** and retract the plunger **54** to unlock the hood latch, the spring **51** of course thereafter shifting the shorting bar **50***b* to the open-circuit condition where the latter connects together contacts **45***b* and **46***b*. Simultaneously, of course, shorting bar **50***a* connects together open contact **45***a* with contact **46***a*. Consequently, the auxiliary circuit is disarmed. The biasing action of springs **51** and **52** is effective in each case to interrupt the current flow from the battery to the solenoid winding **53** after the solenoid plunger **54** has been moved to its desired position, and thereby to prevent a constant current drain on the battery **11**.

Having now described my invention in connection with a particularly illustrated embodiment thereof, modifications and variations of my invention may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of my invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed to be new and useful is:

1. An auxiliary electrical circuit package connectable to the existing electrical circuitry of an automotive vehicle having a battery and an internal combustion engine of the type characterized by ignition of fuel vapors by means of an electrical discharge from an electrical discharge device, comprising in combination, control means connectable to the ignition system of the internal combustion engine and effective only when actuated to prevent fuel ignition by preventing the required electrical discharge from the electrical discharge device, selectively operable actuating means operatively coupled to said control means effective when operated to actuate and deactuate said control means as desired, and an electrically actuatable tear gas bomb having an actuation circuit coupled to and actuatable by the battery through said control means when the latter is actuated, and decoupled from the battery when said control means is deactuated.

2. The combination as described in claim **1** further including time delay means in electric circuit with the said actuation circuit of said tear gas bomb effective to delay for a predetermined time interval the actuation of said bomb.

3. The combination as described in claim **1** further including locking means effective when actuated in a first way to lock the vehicle engine compartment from the inside thereof so that the compartment cannot be opened from the outside and effective when actuated in a second way to unlock the engine compartment, and selectively operable locking means actuating means external to said compartment operatively coupled to said locking means effective when operated to actuate said locking means selectively in said first and second ways, said last named means being coupled to and operable simultaneously with said control means selectively operable actuating means so that the vehicle engine compartment may be locked when said control means is actuated to prevent fuel ignition and may be unlocked when said control means is deactuated to restore normal vehicle operation.

4. The combination as described in claim **1** wherein the internal combustion engine includes an ignition coil having primary and secondary windings and means for causing current bursts through the primary winding to generate potential at the secondary winding normally sufficient to cause the aforesaid electrical discharge from the electrical discharge device, and wherein said circuit package control means when actuated causes a continuous saturating current to flow through the ignition coil primary and thereby suppresses the generation of discharge potential at the secondary winding.

5. The combination as described in claim **1** wherein the automotive vehicle is provided with an electrically operable horn, in an electrical circuit with the battery for operating the horn, and wherein said control means includes means couplable to the electric circuit of the electrically operable horn effective when actuated to condition the horn to automatically sound whenever an attempt is made to start the internal combustion engine, said last named means being selectively actuated and deactuated as aforesaid by said selectively operable actuating means coupled to said control means.

6. The combination as described in claim **2** wherein said time delay means comprises a thermal cut-out switch connected in parallel with and providing an electrical short-circuit by-passing the said actuation circuit of said tear gas bomb, the short-circuit being removed by opening of said thermal cut-out switch after said predetermined time interval.

7. The combination as described in claim **4** further including time delay means in electric circuit with the said actuation circuit of said tear gas bomb effective to delay for a predetermined time interval the actuation of

said bomb, wherein the automotive vehicle is provided with an electrically operable horn in an electric circuit with the battery for operating the horn, said control means including means couplable to the electric circuit of the electrically operable horn effective when actuated to condition the horn to automatically sound whenever an attempt is made to start the internal combustion engine, said last named means being selectively actuated means coupled to said control means, said means for causing current burst through the ignition coil primary winding is a breaker point system having one point connected to the primary winding and the other point at battery return potential, and wherein said control means comprises a switch electrically connectable across the breaker points, said switch being open and closed respectively when said control means is deactuated and actuated respectively, wherein said internal combustion engine is cranked by an electric starting motor energized from the battery, and wherein said control means couplable to the electric circuit of the horn comprises switch means which when closed complete the electric operating circuit of the horn to the battery when the battery is connected to the starting motor.

8. The combination as described in claim **7** wherein said time delay means comprises a thermal cut-out switch connected in parallel with and providing an electrical short-circuit bypassing the said actuation circuit of said

tear gas bomb, the short-circuit being removed by opening of said thermal cut-out switch after said predetermined time interval.

9. The combination as described in claim **8** further including locking means effective when actuated in a first way to lock the vehicle engine compartment from the inside thereof so that the compartment cannot be opened from the outside and effective when actuated in a second way to unlock the engine compartment, and selectively operable locking means actuating means external to said compartment operatively coupled to said locking means effective when operated to actuate said locking means selectively in said first and second ways.

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U.S. Cl. X.R.

307—10; 180—114